

September 29, 2016

Mr. Howard Robinson
Director of Public Works
City of Milton
710 South Janesville Street
Milton, WI 53563

Subject: Preliminary Compliance Alternatives Plan-Phosphorus

Dear Mr. Robinson:

This letter documents the preliminary compliance alternatives plan for phosphorus as required in your Wisconsin Pollution Elimination Discharge System (WPDES) permit. This report needs to be submitted by September 30, 2016. The letter is organized based on the Wisconsin Department of Natural Resources (DNR) Phosphorus Checklist to Completeness: Third Year Preliminary Report.

Background Information

Existing Treatment Facility Description

Figure 1 shows the process schematic for the Milton Wastewater Treatment Plant. The influent flow flows by gravity through a screening process and then to biological treatment. The biological treatment system includes four (4) anaerobic tanks followed by aeration tanks maintained in an aerobic condition. The facility removes most of the phosphorus through biological phosphorus removal. Following aeration, the mixed liquor flows to three (3) final clarifiers, is metered through a Parshall flume, chlorine is added prior to the chlorine contact tank. Following disinfection (May to September) the flow enters an effluent pumping station. The pumps discharge to a force main which carries the treated effluent to the Rock River. The force main outfall joins the Consolidated Koshkonong Sanitary District outfall prior to discharge to the Rock River.

Waste activated sludge is thickened using a gravity belt thickener. Thickened biosolids are stored in a concrete storage tank. The thickened biosolids are spread on farm fields by a contract hauler.

Existing Collection System Information

The Capacity, Management, Operation and Maintenance Program (CMOM) was completed in July 2016. Table 1 provides a summary of system characteristics for the Milton system. Tables 2 provides a summary of flows for 2011 to 2015. Figures 2 and 3 compare infiltration/inflow to accepted United States Environmental Protection Agency (USEPA) benchmarks for infiltration and inflow.

TABLE 1

City of Milton Collection System Characteristics

Sewer Size (inches)	Length (feet)
6-inch	1,452
8-inch	127,377
10-inch	20,343
12-inch	6,160
15-inch	1,081
18-inch	8,104
Force Main	
Length (miles)	3.5
Lift Stations	10

TABLE 2

Flows - 2011 to 2015

	2011	2012	2013	2014	2015	Average
Annual Average Flow (MGD)	0.446	0.437	0.412	0.419	0.379	0.419
Maximum Daily Flow (MGD)	0.646	0.663	1.050	0.843	0.792	0.799
Maximum Weekly Flow (MGD)	0.529	0.526	0.560	0.682	0.454	0.550
Maximum Monthly Flow (MGD)	0.474	0.481	0.494	0.613	0.398	0.492
Maximum Daily to Annual Average	1.45	1.52	2.55	2.01	2.09	1.92
Maximum Weekly to Annual Average	1.18	1.20	1.36	1.63	1.20	1.31
Maximum Monthly to Annual Average	1.06	1.10	1.20	1.46	1.05	1.17

FIGURE 2

Infiltration Benchmarking - Milton, WI

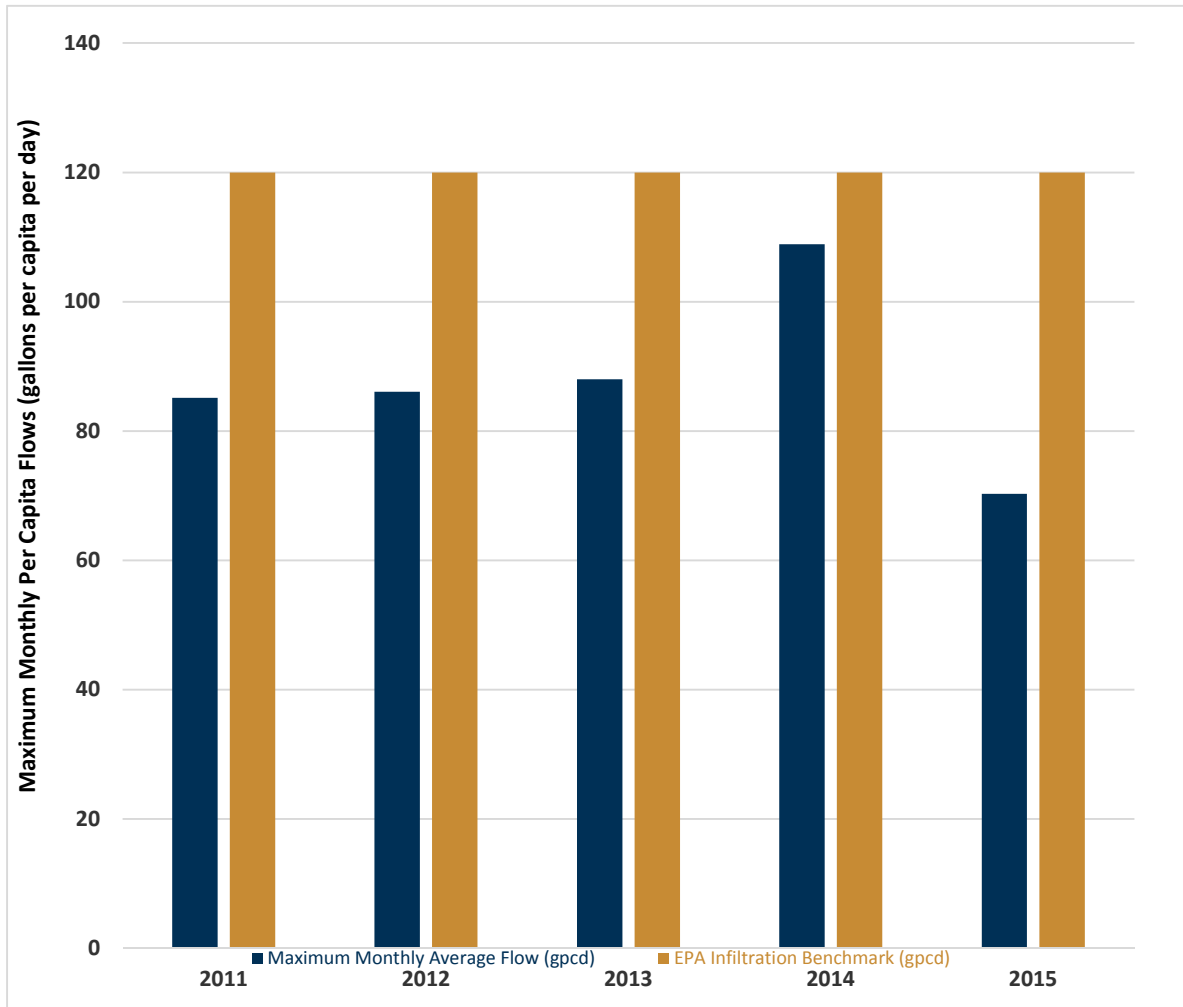
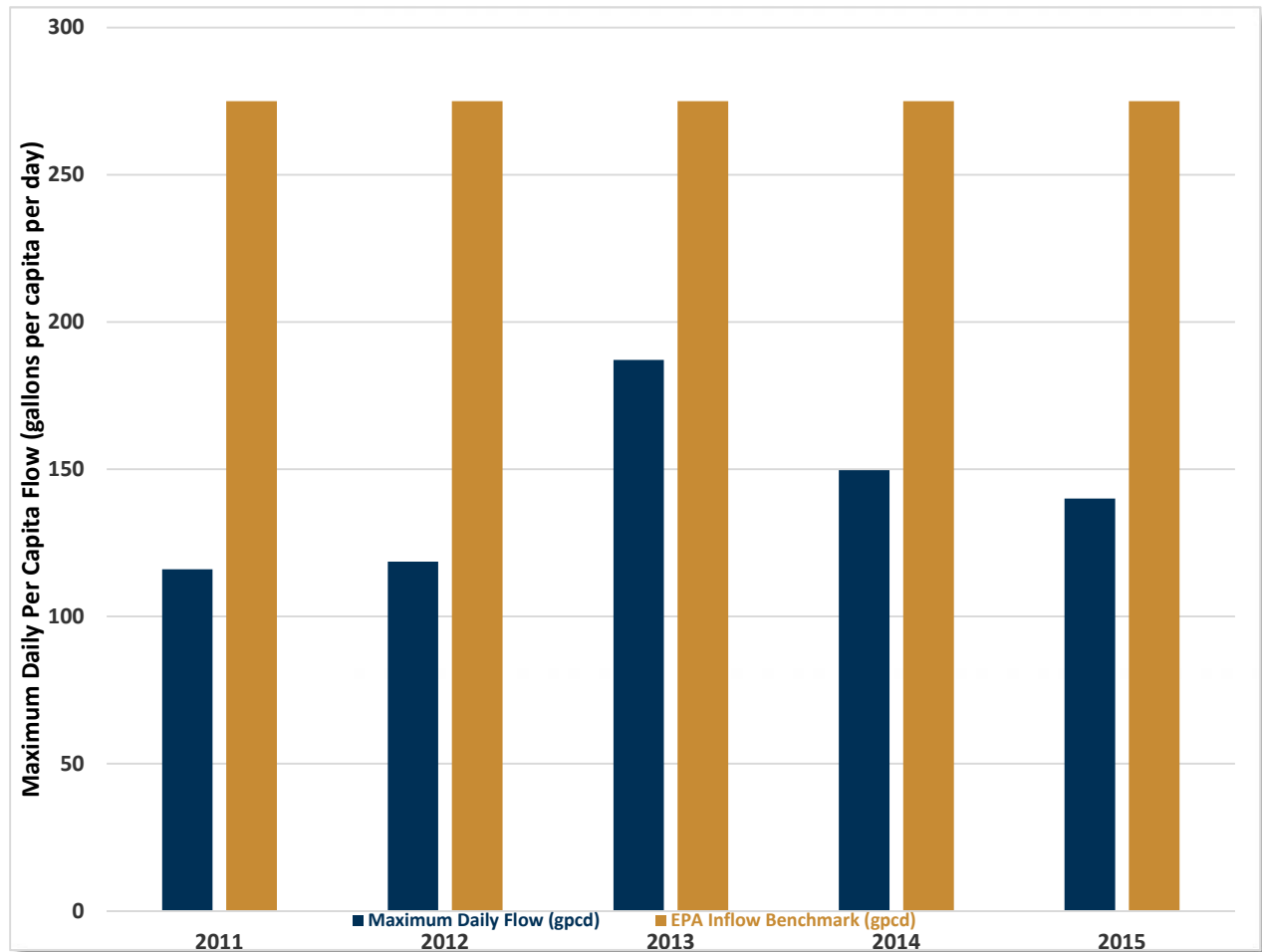


FIGURE 3

Inflow Benchmarking - Milton, WI



Influent Flows and Loadings

Table 2 above summarized the influent flows from 2011 to 2015. Table 3 summarizes the influent loadings for 5 day Biochemical Oxygen Demand (BOD₅), ammonia nitrogen, and total phosphorus (TP).

TABLE 3
Influent Loadings 2011 to 2016

	BOD (lbs/day)	TP (lbs/day)	Ammonia Nitrogen (lbs/day)
2013	935	25	130
2014	955	24	120
2015	883	20	121
2016	864	21	128
Average	910	22	125
Design Loading	1,970	50	350
% Design Loadings	46%	45%	36%

Effluent Total Phosphorus Loadings

Table 4 summarizes the effluent total phosphorus loadings for 2013 to 2016 (through August 2016).

TABLE 4
Effluent Phosphorus Loadings (Lbs/day) 2010 to 2016

	2010	2011	2012	2013	2014	2015	2016	WWTP TMDL
January	0.63	0.44	2.71	3.60	4.62	0.58	0.16	57.4
February	1.04	0.74	1.17	0.27	3.55	4.09	3.09	82.4
March	2.45	1.53	0.95	0.93	4.88	0.73	4.42	56.4
April	4.43	4.70	0.59	1.23	4.37	2.01	3.23	35.3
May	6.58	8.40	2.73	1.30	3.87	0.87	0.82	52.9
June	5.00	6.81	4.57	0.98	1.31	4.46	2.15	12.3
July	5.36	6.58	3.04	1.74	3.39	0.57	2.23	9.21
August	8.56	9.06	1.68	1.61	1.09	1.16	2.61	2.2
September	6.44	4.03	1.02	2.14	1.80	0.95		17.8
October	3.95	2.74	1.15	1.11	1.01	0.62		14.7
November	3.28	6.85	1.00	4.37	0.59	0.29		17.9
December	0.99	4.80	3.78	3.14	0.43	0.17		33.7

The Rock River Total Maximum Daily Load (TMDL) for total phosphorus is also included in this table. These values would have been met except for August 2010 and August 2011. The permit limit in 2010 was 1.5 mg/L similar to the current interim limit for total phosphorus.

Table 5 summarizes the effluent phosphorus concentrations. The existing facility has been in compliance with the interim limit of 1.5 mg/L since 2013.

TABLE 5

Effluent Total Phosphorus Concentrations 2013 to 2016

	2013	2014	2015	2016	Interim Limit (mg/L)	Effective TMDL Limit (mg/L)
January	0.93	1.22	0.20	0.05	1.5	11.01
February	0.09	0.78	1.39	0.92	1.5	15.81
March	0.31	0.95	0.23	1.32	1.5	10.82
April	0.39	1.12	0.68	0.95	1.5	6.77
May	0.43	1.14	0.28	0.23	1.5	10.15
June	0.29	0.40	1.36	0.60	1.5	2.36
July	0.58	1.06	0.18	0.65	1.5	1.77
August	0.49	0.37	0.36	0.74	1.5	0.42
September	0.64	0.59	0.29		1.5	3.41
October	0.29	0.35	0.19		1.5	2.82
November	1.06	0.20	0.09		1.5	3.43
December	0.78	0.15	0.05		1.5	6.47
Average	0.52	0.69	0.44	0.69		
Note:	1. Effective TMDL limit is based on the average daily design flow rate of 0.625 MGD.					

Optimization Plan Summary

The optimization plan for Milton included using a portable ORP probe to monitor the condition of the anaerobic and anoxic zones and the purchase of an on-line phosphorus analyzer. The on-line analyzer was installed in early 2016 and placed into operation on February 5, 2016. The staff uses this as a tool to determine when alum needs to be added to supplement the biological phosphorus removal. The critical month for Milton is August since the total maximum daily loading (TMDL) is 2.2 lbs/day as summarized in Table 4. The facility also has the capability of using the phosphorus analyzer to pace the addition of alum.

Milton does not have effluent filters. Process upsets resulting in the discharge of suspended solids could affect the ability of the facility to meet the August effluent limit. At the average daily design flow rate of 0.625 MGD, the effective limit for total phosphorus would be 0.42 mg/L. Typical phosphorus concentrations of TSS in a facility using biological phosphorus removal are 5 to 6 percent of the biomass. If the total suspended solids were 10 mg/L, the resulting total phosphorus value would be 0.5 to 0.6 mg/L which would potentially be a violation of the TMDL limit.

One industry in Milton had the potential to cause a process upset if product is discharged to the sewer system (Air Products). Air Products manufactures quaternary amine products which are both inhibitory and toxic to activated sludge organisms. If this product discharged in sufficient quantities it can cause a major process upset including loss of nitrification, impacts on biological phosphorus removal, effluent BOD₅, and total suspended solids. Figure 4 shows the effects of a process upset in May 2014 and the resulting effects on effluent ammonia and total phosphorus. The event occurred after a 2.85 inch rainfall on May 12, 2016. The containment area for Air Products is discharged to the wastewater treatment after every rainfall. Based on a 2.85 inch rainfall, the total amount of water discharged to the City sewer would be about 124,000 gallons. Based on the effluent results, there may have been product in the storm water discharged to the sewer system. The effluent total phosphorus for May of 2014 was 3.9 lbs/day of total phosphorus. If this event had occurred in August of any given year, the TMDL value of 2.2 lbs/day would have been exceeded. The monthly average effluent total suspended solids for May 2014 was 7 mg/L while the monthly average total phosphorus was 1.14 mg/L. Of this amount, the suspended solids contribution of total phosphorus would have been about 20 to 40 percent of the average value.

The phosphorus analyzer is interlocked with the Supervisory Control and Data Acquisition (SCADA) computer system. Alum addition can be paced by the analyzer. The plant staff could set a phosphorus analyzer set point that would add alum if the target set point is exceeded, for the critical month of August for TMDL compliance. The analyzer measures ortho-phosphorus, not total phosphorus, so that if there are significant effluent total suspended solids due to a process upset in August, the TMDL limit may be violated.

Milton should consider requiring Air Products to install equalization facilities for the containment area of their facility. This would allow for a measurement to be made of quaternary amines and determine an appropriate discharge rate to avoid any process upsets.

An additional option to provide for more operational information, would be to install a permanent ORP probe in the anaerobic zone. This would allow staff to have real-time information about ORP to determine if changes in ORP in the anaerobic zone predict a potential process upset.

FIGURE 4

May 2014 Effluent Ammonia Nitrogen and Total Phosphorus

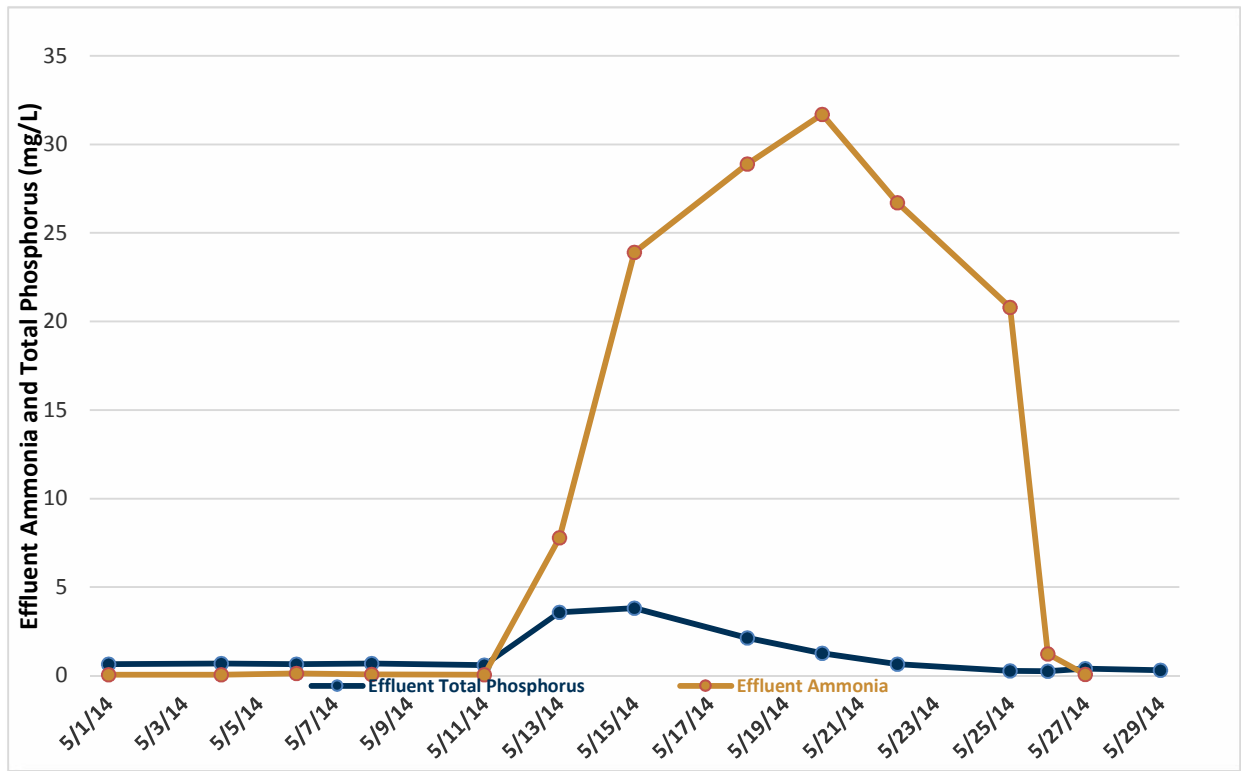


Table 6 shows the amount of alum addition for each month from 2013 to 2015. There was a reduction in alum usage between 2014 and 2015 from a total year addition of 4,200 gallons to 1,700 gallons. With the addition of the phosphorus analyzer, the staff has been able to continue to reduce the amount of alum required to meet the current 1.5 mg/L interim limit.

TABLE 6
Alum Addition 2013 to 2016

	2013 (gpd)	2014 (gpd)	2015 (gpd)	2016 (gpd)
January	0	29.4	0	0
February	0	22.6	13.4	0
March	0	18.4	0	0
April	0	19.8	0	16.4
May	12.5	20.3	0	2.5
June	9.6	19	14.8	5.4
July	6.6	5.2	18.4	9.4
August	11.7	3.9	9.7	20.4
September	15.6	0	0	
October	15.9	0	0	
November	0	0	0	
December	24	0	0	

Biosolids Production and Phosphorus Balance

Table 7 summarizes the biosolids production and material balance for total phosphorus. The measured value for phosphorus in the 2013 biosolids was 5.8 percent versus lower values for 2014 (3.2%) and 2015 (3.7%). The material balance in 2014 was the closest overall with difference of 2.5 percent between the influent total phosphorus and the combined biosolids and effluent total phosphorus.

TABLE 7
Biosolids Production and Material Balance for Total Phosphorus

	Biosolids Disposed (gallons)	Biosolids Disposed (lbs)	Biosolids Yield				
			Influent BOD (lbs)	Yield (lbs TSS/ lbs BOD)	Biosolids P (lbs)	Influent P (lbs)	Effluent P (lbs)
2013	604,200	292,264	341,134	0.86	16,951	9,016	682
2014	546,500	237,006	332,854	0.71	7,584	8,742	940
2015	521,900	230,690	321,886	0.72	8,559	7,176	502

Building Treatment Alternatives

The most recent complete upgrade for Milton was completed in 2003. The facility has adequate capacity for anticipated growth for the next twenty years unless a significant wet industry locates in Milton. All of the facilities are in good operating condition and no major upgrades (with the possible exception of phosphorus compliance) are expected in the next 10 years. Routine equipment replacement will occur as equipment ages.

The City of Milton is also in the process of evaluating conversion from chlorine disinfection to UV disinfection. UV disinfection would provide effluent disinfection at a lower total present worth than chlorine disinfection. A separate report was prepared comparing alternatives for disinfection.

Two options that would involve constructing facilities were evaluated in detail: effluent filtration and groundwater disposal. Regionalization does not provide an option which would provide for compliance with the TMDL limit and is not recommended at this time given the age and condition of the existing facilities.

Effluent Filtration

Effluent filtration would provide protection for suspended solids disposal if there was a significant process upset during August. The effluent filtration system would likely be a cloth-filter system since the effective TMDL limit at the design flow rate of 0.625 MGD would be 0.42 mg/L. Based on the current hydraulic grade available at Milton, a filtration pumping station would be required to lift the effluent prior to disinfection to provide sufficient head for filtration operation. The design flow rate for filtration would be maximum hour flow or about 2.2 MGD. Table 8 summarizes the costs for effluent filtration for the City of Milton.

TABLE 8

Effluent Filtration Costs - 2016

ITEMS	COST
Filters	\$ 457,000
Installation	\$ 114,000
Structure	\$ 223,000
Lift Pumps	\$ 57,000
Subtotal	\$ 851,000
Piping	\$ 85,000
Site	\$ 34,000
HVAC	\$ 26,000
Electrical	\$ 153,000
Subtotal	\$ 1,149,000
Contractors OHP	\$ 172,000
Subtotal	\$ 1,321,000
Contingencies/Technical Services	\$ 529,000
Total Project Cost	\$ 1,850,000

Groundwater Disposal

One option to meet the August TMDL would be to use land treatment if the effluent discharge would exceed the August monthly TMDL limit of 68.2 pounds per month. At the average daily design flow rate of 0.625 MGD, Milton would be allowed to discharge phosphorus at an average monthly rate of 0.42 mg/L which is a concentration slightly lower than typically feasible with filtration (0.6 mg/L). At a concentration of 0.6 mg/L and the design average daily flow rate of 0.625 MGD, the resulting monthly load would be about 97 pounds in August which would be less than wastewater treatment plant plus the MS4 load of 102 lbs/month (See discussion of the watershed information and water quality trading).

The approximate sizing required for land disposal would be based on typical loadings for land disposal. Two potential types of systems would be possible: infiltration or spray irrigation. Spray irrigation is not a practical alternative for Milton since effluent would only need to be applied for a short period of time in August. A typical infiltration system (provided appropriate soils are available) would have a loading rate of about 1 gpd/sf. At the design flow rate of 0.625 MGD, the basic infiltration area required would be 625,000 sf or about 14 acres. Typical systems are designed for loading and resting, so to allow for proper resting, another 14 acres would be recommended. Another 12 acres would be required for buffer and roads with the resulting land requirement of 40 acres. Based on this amount of required land, the unlikelihood of finding sufficient acreage and the limited need for this potential option, it is not recommended to pursue land disposal for the City of Milton.

Watershed Information

Figure 5 summarizes the HUC 12 watershed map for Milton. Milton is an MS4 and the location of the boundaries of Milton are shown in Figure 4. Milton's storm water discharge is internally drained and does not outlet to the Rock River. The Milton MS4 received a TMDL allocation for the Rock River TMDL which is not needed since there is no discharge to the Rock River for Milton storm water. The allocation for August for the Milton MS4 is 1.1 lbs/day which if traded with the Milton Wastewater Treatment Facility would provide the Milton Wastewater Treatment Facility with a monthly allocation of 102.2 lbs/month or an increase of 34.1 lbs/month. At the design flow rate of 0.625 MGD, this would translate to an equivalent monthly average concentration of 0.63 mg/L. This would be very close to a 10 mg/L discharge of TSS for phosphorus compliance.

For Milton, the PRESTO ratio (point source to non-point source) is 23 percent point sources and 77 percent non-point sources. Milton would potentially be eligible for Adaptive Management but since there is only one month where alternatives to the existing facility operation are required to meet the Rock River TMDL limit, this alternative will not be evaluated in detail.

Adaptive Management

As discussed above, since there is only a single month where alternative compliance methods are required, Adaptive Management was not evaluated in detail since it would be difficult to document an improvement in water quality through sampling.

Water Quality Trading

Water quality trading was discussed in the Watershed Information section of this letter. The proposed trade would be between the City of Milton Wastewater Treatment Facility and the City of Milton MS4. This trade would provide an additional loading of 34.1 lbs/month to provide additional protection should the treatment plant have a process upset in August of sufficient length that its allocation for the Rock River TMDL would be exceeded. A Notice of Intent to trade is attached to this letter.

Variance

The City of Milton would not be eligible for either an individual economic variance or a multi-discharger variance since the rates required for constructing facilities to meet the Rock River TMDL limit would not increase the average residential charge to more than 1% of MHI. These calculations are summarized in Table 8. Milton could potentially be eligible for an individual variance based on hydrologic modifications on the Rock River, but the level of effort required to document this variance condition would not be warranted for a potential limit stricter than the current interim limit of 1.5 mg/l for one month out of the year.

TABLE 9

Impact of Constructed Facilities on Wastewater Rates

Current Annual Cost	\$ 333
MHI	\$ 51,397
Annual Cost/MHI	0.65%
Current Budget	\$ 1,030,000
Debt Retirement-Phosphorus	\$ 220,000
Operating Costs-Phosphorus	\$ 162,000
Proposed Budget	\$ 1,412,000
Rate Increase	37%
Revised Annual Cost	\$ 457
Revised Annual Cost/MHI	0.89%

The debt retirement costs and the operating costs including in Table 9 were obtained from the following document: “Phosphorus Economic Impact Analysis Report” prepared for the Wisconsin Department of Administration by Arcadis, Sycamore Advisors, and the University of Massachusetts. The report was dated April 24, 2015 and was included in the Wisconsin DNR submittal to the United States Environmental Protection Agency for approval of the Multi-Discharger variance.

Financials for Municipalities

The financial information for Milton was included in the section on Variances.

Miscellaneous

Since Milton is subject to a TMDL limit, no stream monitoring was performed or is being considered. Milton has monthly low flows calculated by USGS but no change has been requested with regard to phosphorus compliance. Final limits based on flows do not need to be recalculated.

Conclusions

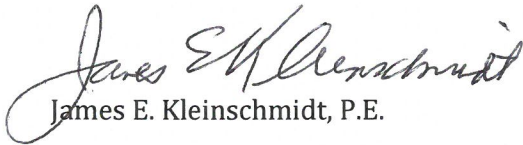
1. Use of the phosphorus analyzer has allowed staff to reduce the amount of alum required so the dose can be based on effluent ortho-phosphorus. There has been a reduction in alum usage for the first couple of months when the analyzer has been in service.
2. Air Products storm water discharges may have caused process upsets in the past. If a process upset were to occur in August, Milton may have some issues with meeting their TMDL total phosphorus limit.
3. Trading with the Milton MS4 can provide a little additional loading for total phosphorus in August. The Milton MS4 has an allocation for the Rock River TMDL but the MS4 does not discharge to the Rock River since it is internally drained.

Recommendations

1. Milton should consider meeting with Air Products to review the need to provide equalization for the storm water discharged from its containment area.
2. Milton should submit a Notice of Intent to Trade with the City’s MS4. A copy of that notice of intent is attached.
3. Milton should consider installing a permanent ORP probe in the anaerobic zone of the facility to provide real-time ORP monitoring.

Sincerely,

BAXTER & WOODMAN, INC.
CONSULTING ENGINEERS



James E. Kleinschmidt, P.E.

JEK:jmc

Enclosure: Notice of Intent to Apply for Trading, Figure 1 and Figure 5

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Notice of Intent to Conduct Water Quality Trading

Form 3400-206 (1/14)

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Notice: Pursuant to s. 283.84, Wis. Stats., and ch. NR 217 Wis. Adm. Code, this form must be completed by any WPDES permittee that is using water quality trading as a method of complying with a permit limitation. Failure to complete this form would not result in penalties. Personal information collected will be used for administrative purposes and may be provided to requesters to the extent required by Wisconsin's Open Records Law (ss. 19.31 - 19.39, Wis. Stats.).

Applicant Information

Permittee Name City of Milton		Permit Number WI- WI-0060453-08-0		Facility Site Number	
Facility Address			City	State	ZIP Code
Project Contact Name (if applicable) Howard Robinson		Address		City	State
Project Name Milton					
Receiving Water Name Rock River		Parameter(s) being traded Phosphorus		HUC 12(s) 070900021004	

Is the permittee in a point or nonpoint source dominated watershed?
(See PRESTO results - <http://dnr.wi.gov/topic/surfacewater/presto.html>)

☐ Point source dominated
☒ Nonpoint source dominated

Credit Generator Information

Credit generator type (select all that apply):

☐ Permitted Discharge (non-MS4/CAFO) ☐ Urban nonpoint source discharge
☒ Permitted MS4 ☐ Agricultural nonpoint source discharge
☐ Permitted CAFO ☐ Other - Specify: _____

Are any of the credit generators in a different HUC 12 than the applicant? ☐ Yes; HUC 12: _____
☒ No
☐ Unsure

Are any of the credit generators downstream of the applicant? ☐ Yes
☒ No
☐ Unsure

Will a broker/exchange be used to facilitate trade? ☐ Yes; Name: _____
☒ No
☐ Unsure

Point to Point Trades (Traditional Municipal / Industrial Discharge, MS4, CAFO)

Discharge Type	Permit Number	Name	Contact Address	Is the point source credit generator currently in compliance with their permit requirements?
<input type="radio"/> Traditional <input checked="" type="radio"/> MS4 <input type="radio"/> CAFO		City of Milton		<input checked="" type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unsure
<input type="radio"/> Traditional <input type="radio"/> MS4 <input type="radio"/> CAFO				<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unsure
<input type="radio"/> Traditional <input type="radio"/> MS4 <input type="radio"/> CAFO				<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unsure
<input type="radio"/> Traditional <input type="radio"/> MS4 <input type="radio"/> CAFO				<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unsure
<input type="radio"/> Traditional <input type="radio"/> MS4 <input type="radio"/> CAFO				<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Unsure

Notice of Intent to Conduct Water Quality Trading

Form 3400-206 (1/14)

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Point to Nonpoint Trades (Non-permitted Agricultural, Non-Permitted Urban, etc.)

List the practices that will be used to generate credits:

Use MS 4 allocation for August (1.1 lbs/day) to provide an allocation which the wastewater treatment plant can meet reliably under normal operating conditions.

Method for quantifying credits generated: ☐ Monitoring
☐ Modeling, Names: _____
☒ Other: TMDL _____

Projected date credits will be available: 08/01/2019

The preparer certifies all of the following:

- I am familiar with the specifications submitted for this application, and I believe all applicable items in this checklist have been addressed.
- I have completed this document to the best of my knowledge and have not excluded pertinent information.

Signature of Preparer

Date Signed

James E. H. Henshaw

09/28/2016

Authorized Representative Signature

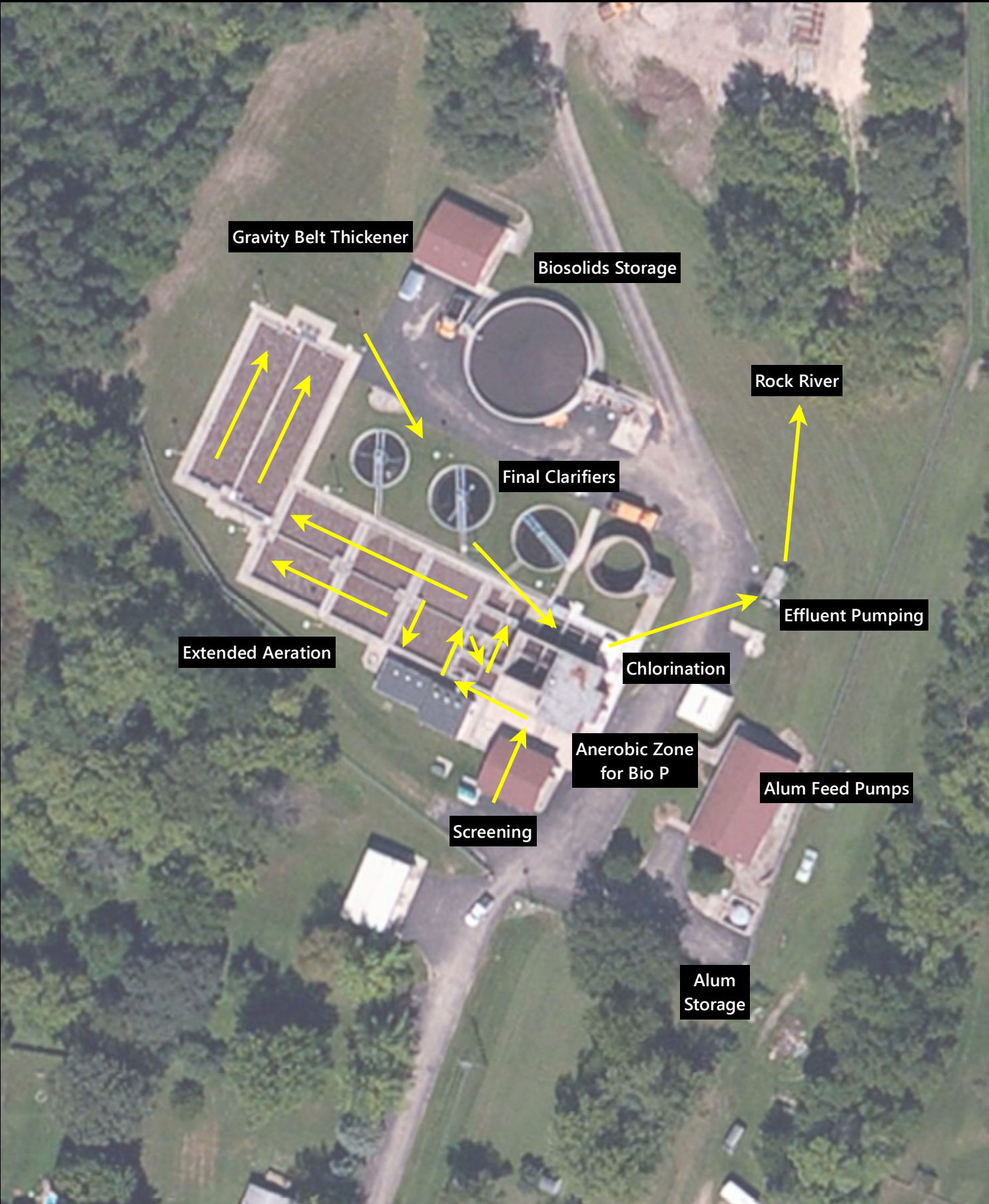
I certify under penalty of law that this document and all attachments were prepared under my direction or supervision. Based on my inquiry of those persons directly responsible for gathering and entering the information, the information is, to the best of my knowledge and belief, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature of Authorized Representative

Date Signed

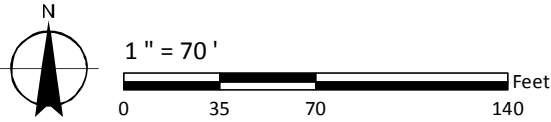
Donald H. Henshaw

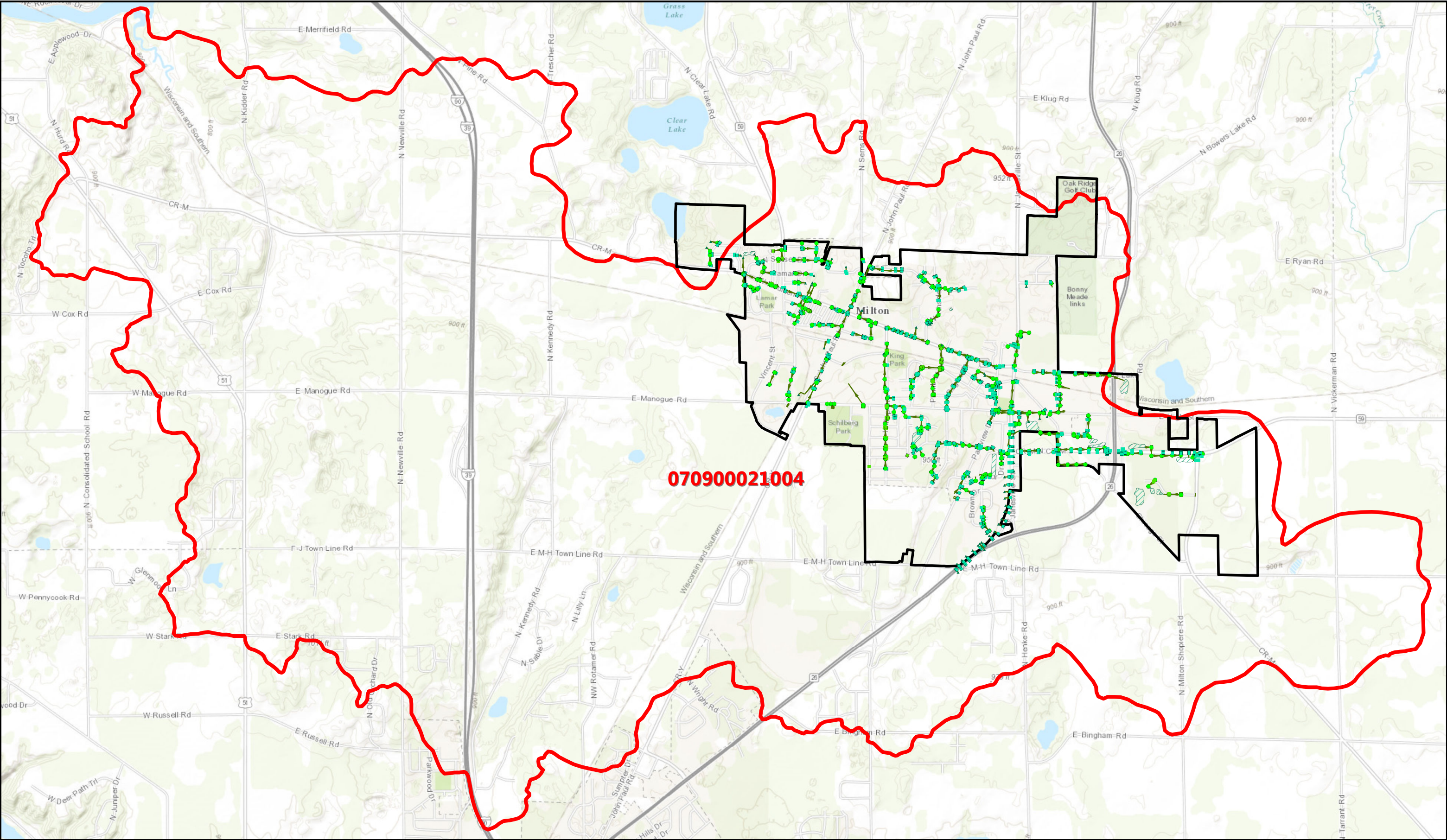
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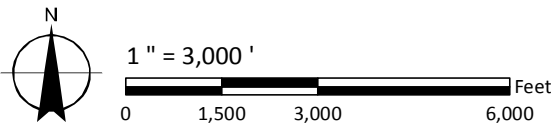
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Source(s): Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community





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- Storm Sewer System
- Detention Basin
- HUC 12 Boundary
- Corporate Boundary